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Cardio-surgical instrument filter-trap - has pipe-conductor and capsule  
attached to rod between framework and filtering element

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Abstract (Basic): SU 764684 B

The filter has a pipe-conductor (4), a framework with filtering element (1) and capsule (6). To increase the efficiency, and improve filter location and removal during cardio-surgery, the capsule is attached to rod (5) between the framework and the filtering element. The framework outer edge is provided with a flexible ring (2).

Ring (2) is made of levers (3) hinged to pipe conductor (4) which contains rod (5). Rod (5) has a directing cone (11) and pipe-conductor has reverse cone (12). The filter is moved into the aorta in a folded state. Rod (5) with capsule displacement causes levers (3) to open until they rest on the aorta wall. Bul.35/23.9.80

Union of Soviet Socialist Republics  
USSR State Committee on Inventions and Discoveries

**SPECIFICATION OF INVENTION  
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**(54) FILTER TRAP**

The invention pertains to medical technology, specifically, to heart surgery instruments.

There is a known filter trap, which contains a conductor tube with shaft, a capsule, as well as a round-shaped plastic plate with openings, in which is press-fitted a metal framework, giving the filter the shape of an umbrella. Around the rim of the filter there are sharp teeth, being extensions of the framework, which are designed to secure the filter to the walls of the inferior vena cava. The filter, in its collapsed form enclosed in the small metal capsule, is introduced under X-ray monitoring by means of the conductor tube through the jugular vein into the inferior vena cava and secured herein by introducing its sharp teeth into the wall of the inferior vena cava [1].

The shortcomings of this filter trap are its extremely limited capabilities of use, being primarily due to the circumstance of its only one-sided action, specifically, when open and installed inside the vena cava the filter is structurally unable to fold up again and be retracted into the capsule. As a result, its use does not preclude cases of severe trauma to the patient, caused by damage to the walls of the inferior vena cava, the surrounding tissues and organs, etc. Furthermore, when left behind in the lumen of the inferior vena cava, the filter itself is a site of deposition of blood clots which may eventually lead to complete blockage of the inferior vena cava.

The purpose of the invention is to provide an atraumatic introduction, fixation, and removal of the filter during heart surgery operations.

The stated purpose is achieved in that the capsule in the filter trap is secured to the shaft between the framework and the filtering element, while the outer edge of the framework is provided with an elastic ring.

Figure 1 shows the filter trap in its working position; Fig. 2 the same, in the collapsed state; Fig. 3, the control mechanism, in the working position; Fig. 4, the same, with the filter collapsed; Fig. 5 and 6, instances of use of the filter trap during an operation.

In the proposed filter trap, the filtering element 1 with elastic ring 2 is secured on the outside to the rim of the framework, which is composed of levers 3, hinged to the conductor tube 4, inside which is placed the shaft 5. One end of the shaft 5 is provided with the capsule 6, which is placed with its open end toward the conductor tube 4 at the apex of the filtering element 1. The other end of the shaft 5 is connected to the rod 7 of the control mechanism, whose body 8 is firmly joined to the conductor tube 4. On the body 8 is secured a fixator 9 and there is mounted a return spring 10. The shaft 5 has a guide cone 11, while the conductor tube 4 has an inverted cone 12.

The filter trap works as follows.

During the heart surgery operation, for example, a mitral commissurotomy, the filter trap in

the collapsed state is conducted through the opening in the wall of the left ventricle to the ascending branch of the aorta, immediately behind its valves. By pressing on the rod 7 of the control mechanism, one brings about a displacement of the shaft 5 with the capsule 6 relative to the conductor tube 4 until the levers 3 of the framework are released. Further displacement of the shaft 5 with the capsule 6 results in stretching of the filtering element 1 and deployment of the levers 3 of the framework until they thrust against the wall of the aorta, being controlled from the outside by the surgeon's hand. A tight abutment of the edge of the filtering element 1 is ensured by the tension of the elastic ring 2, and in this process the spring 10 is compressed. In the installed position, the rod 7 is secured relative to the body 8 by the fixator 9, after which the auricle of the left atrium is exposed and then the mitral commissurotomy is performed in the usual way.

The blood clots occurring in the cavities of the left side of the heart and penetrating into the aorta during the commissurotomy are gathered in the filter trap, which at the same time does not impede the free flow of blood in the aorta. After the commissurotomy is performed, the fixator 9 is released and, under the action of the return spring 10, the shaft 5 with the capsule 6 moves toward the levers 3 of the framework. The levers 3 fold up and go into the capsule 6, while the filtering element 1 along with the blood clots 13 encloses the capsule 6 on the outside. Next, the filter trap is taken out in the collapsed condition. The guide cone 11 and the inverted cone 12 facilitate the taking of the filter trap through the opening in the wall of the left ventricle and that in the cusps of the aortal valve.

Thus, the filter trap allows a substantial reduction of the danger of thromboembolism of the main blood vessels during an operation, for example, during the very common operation of mitral and aortal commissurotomy, expands the range of indications for surgical operation, improves the effectiveness thereof, and facilitates the operating technique. Moreover, a regulated deployment of the filter trap is possible, depending on the diameter of the patient's aorta, which dispenses with the need to create a set of similar instruments of different calibers.

The use of the filter trap does not require an additional surgical intervention and it is safe. The instrument can be used during both the "closed" and the "open" heart surgery technique (with artificial blood circulation), since even the most careful removal of blood clots from the cavities of the left ventricle during operations under artificial blood circulation does not guarantee that tiny blood clots and calcinates will not get into the vessels of the brain.

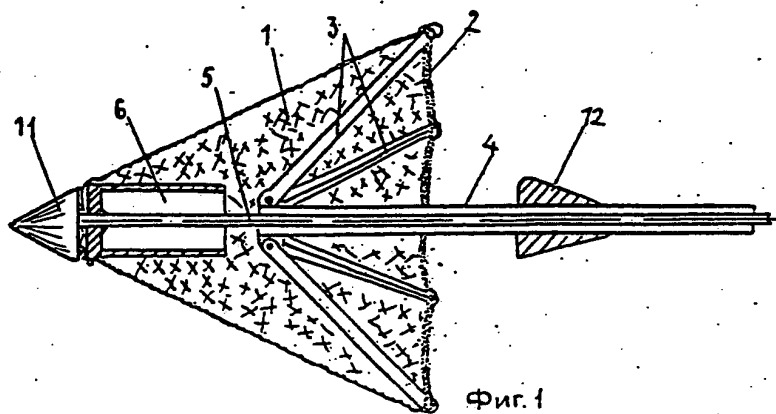
#### Claims

Filter trap, containing a conductor tube with shaft, a framework with filtering element, and a capsule, characterized in that, for an atraumatic introduction, fixation, and removal of the filter during heart surgery operations, the capsule is secured to the shaft between the framework and the filtering element, and the outer rim of the framework is provided with an elastic ring.

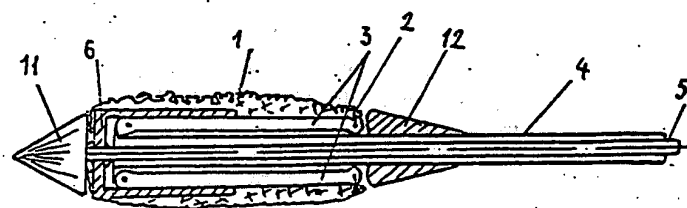
#### Sources of information

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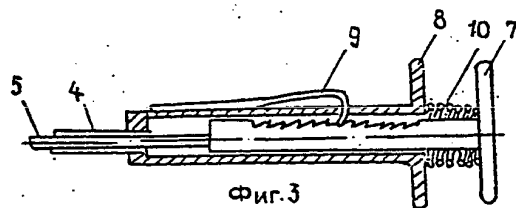
1. "Grudnaya khirurgiya", 1977, No. 3, pp. 15-25.



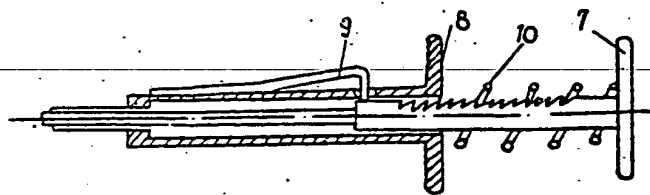
Фиг. 1



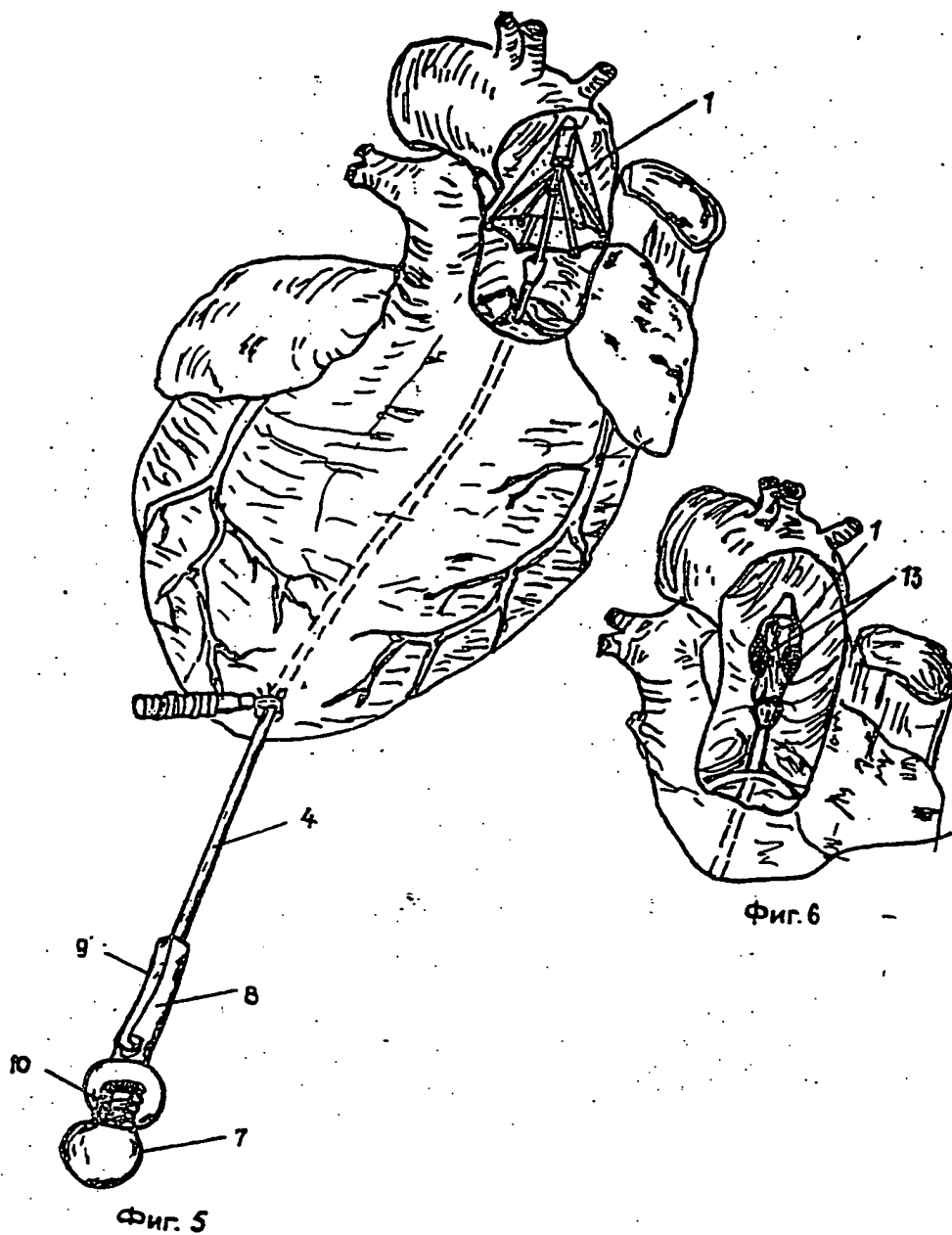
Фиг. 2



Фиг. 3



Фиг. 4



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